



Alternative 8 - Summary

Chain of Lakes Isolated Facility

Emphasis

This alternative improves water quality of diversions, protects fish from diversion effects, and increases water supply reliability through construction of an isolated in-Delta facility consisting of a series of Delta islands linked by siphons into a "chain-of-lakes."

Distinguishing Features

This alternative is intended to provide **moderate to high** levels of resource improvement and conflict resolution.

| Physical/Structural | Operational/Management | Institutional/Policy |
|---|---|--|
| <ul style="list-style-type: none"> • Connect selected Delta islands into an interconnected storage facility (300,000 to 600,000 AF) and conveyance system • Divert water through multiple screened intake structure(s) along its length • Moderate level of habitat restoration • High level of levee improvements • Construct additional reservoir or groundwater storage capacity downstream • Install screens on high and moderate priority diversions | <ul style="list-style-type: none"> • Divert water at times and locations that cause the least environmental harm • Water stored in the chain-of-lakes can be used to reduce direct in-Delta diversions during times of high environmental sensitivity • Operate upstream reservoirs in conjunction with the chain-of-lakes storage to increase supply available for environmental and other uses • Obtain 100,000 AF of water in San Joaquin River from willing sellers and manage for environmental purposes | <ul style="list-style-type: none"> • Funded levee improvements, emergency management plan, and landside buffer zones to reduce system vulnerability |

Benefits

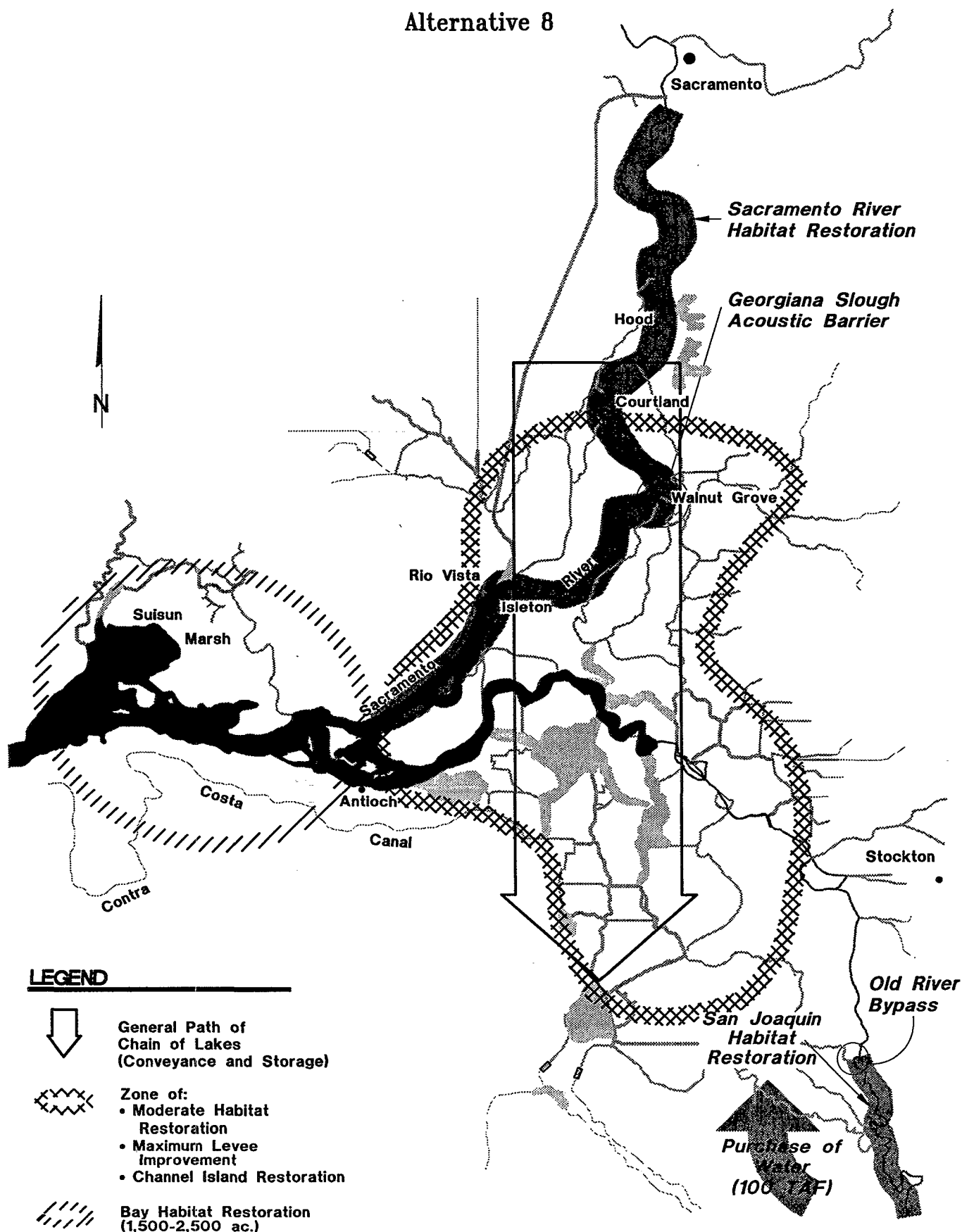
- Improves ecosystem quality through moderate habitat restoration and reduced diversion impacts
- Improves water quality of diversions to extent that quality is not degraded on islands
- Improves water supply predictability and reliability
- Funded levee management program decreases vulnerability of Delta functions to catastrophic failure

Constraints and Concerns

- Environmental and social equity impacts of land use conversions
- Potential for degraded water quality in south and central Delta
- Some Delta islands remain vulnerable
- Screening and real-time monitoring may not be as effective as necessary to avoid entrainment
- Organic carbon loading must be managed
- Larvae of some important fish species remain vulnerable to entrainment

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Overview

This alternative substantially restructures the Delta system to reduce entrainment effects on fish. Diversions will be relocated and habitat restored in ways that improve water supply reliability and reduce system vulnerability.

diversion relocations reduce fish impacts

Currently, the SWP and CVP operations modify natural flow patterns, moving fish into the South Delta where many of the fish are entrained and killed. Under the ESA, limits are set on fish entrainment (take limits) to avoid jeopardizing fish populations. When these limits are approached, pumping is temporarily reduced or stopped. The constant threat of a temporary pumping reduction or shut-down makes it difficult for export water users to predict or rely on their water supply. This alternative moves the SWP and CVP diversions to multiple points in the Delta and on the Sacramento River. This will reduce flow modifications and eliminate fish being drawn into the South Delta and killed at the export pumps. Complementary habitat improvements and fish screening will improve overall ecosystem health and further increase fish populations. Consequently, as fish populations recover and become more stable, ESA take limits should become less of a threat to water supply operations, not only for the SWP and CVP, but for all water users in the Sacramento and San Joaquin Basins.

reducing impacts on fish improves water supply reliability

A chain of contiguous islands from the Sacramento River in the North Delta to the existing SWP and CVP pumps will be converted into water storage reservoirs. Each reservoir will be connected to adjacent reservoirs by large inverted siphons (pipes). At its northern end, this "chain of lakes" will be fed by a screened diversion from the Sacramento River. Other screened diversions will feed the chain of lakes at various points in the Delta. The chain of lakes, which will be isolated from Delta channels, will convey water to the SWP and CVP pumps. The chain will also deliver water to Delta water users. At any given time, the diversion or diversions that will least impact fish will be used to fill the reservoirs. At times when fish could be most impacted, diversions will be reduced or stopped, and water users will draw on stored water. The reservoirs may be filled and emptied several times each year. Organic soils will be removed or sealed from the reservoirs to avoid potential water quality problems with the stored water.

a chain of islands will be connected into water storage reservoirs

This alternative will restore moderate amounts of habitat in the Delta and upstream in the Sacramento and San Joaquin River systems by restoring channel features to improve survival of anadromous fish. In addition, the conversion of Delta islands into storage reservoirs is designed to incorporate substantial aquatic and terrestrial habitat improvements. Extensive levee improvements will incorporate habitat improvements. A moderate level of shallow tidal habitat will be developed in Suisun Marsh to benefit migrating salmon and provide spawning and rearing areas for Delta Smelt.

moderate habitat restoration upstream, in the Delta, and in Suisun Marsh

extensive levee improvements

With the SWP and CVP diversions relocated, fresh water inflow to the Central and South Delta will be reduced, threatening water quality. Therefore, this alternative includes a supplemental water supply purchased from San Joaquin basin water users. This supplemental supply will increase the flexibility of environmental releases of water, improving water quality in the Central and South Delta while improving fish transport through the Delta. Additionally, overall water quality will be improved by pollutant source controls.

*water purchases
to protect water
quality and
improve fish
transport*

By increasing fish populations and improving aquatic habitat, ESA take limits that affect pumping operations should be less constraining, thereby improving water supply reliability and predictability. Habitat restoration simultaneously reduces system vulnerability and protects overall water quality.

Physical and Structural Features

Water Storage

| Activities | Benefits |
|---|--|
| <ul style="list-style-type: none"> • Connect selected Delta islands into an interconnected storage (300,000 to 600,000 AF) and conveyance system • Relocate SWP and CVP screened diversions to multiple points between their current locations and the Sacramento River | <ul style="list-style-type: none"> • Reduces entrainment of fish • Storage allows diversions to be curtailed during periods of high environmental sensitivity • Improves export water quality |
| <ul style="list-style-type: none"> • Increase downstream storage | <ul style="list-style-type: none"> • Improves system operation by providing additional flexibility |
| Considerations | |
| <ul style="list-style-type: none"> • Locate new environmentally dedicated Delta storage reservoir near export pumps on one or more islands such as Bacon, Mandeville, or Victoria. • Divert water during November, December, and January; release water from March to July as needed. With real-time monitoring, divert when species of concern are not present and release water to move fish or release for diversion. • Environmentally dedicated water storage in the Delta allows reduction in diversions during critical periods. • Creation of a wide riparian and shallow water habitat corridor around the perimeter of Delta island storage would provide additional fish and wildlife benefits. • Remove or seal organic soils on reservoir islands to avoid release of carbon into stored water, adversely impacting water quality. • Potential water savings from isolated diversions may provide additional water to beneficial uses. | |

Habitat Restoration

| Activities | Benefits |
|--|---|
| <ul style="list-style-type: none"> • Restore riparian, shaded riverine, and shallow water habitat along the Sacramento River channel between Sacramento and Collinsville | <ul style="list-style-type: none"> • Provides substantial improvement in aquatic habitat as well as improvements in water supply reliability and water quality • Increases survival and spawning success of anadromous and Delta native fish |
| <ul style="list-style-type: none"> • Restore Delta and floodway corridor shallow water, riparian, terrestrial, and tidal wetland habitat • Restore approximately 75 to 125 miles of shallow water, riverine, and riparian habitat along Delta levees in addition to habitat restored on upgraded storage island levees | <ul style="list-style-type: none"> • Provides spawning areas for Delta native fish and forage areas and escape cover for juvenile salmon, Delta smelt, splittail, and other species. Provides improvements in water supply reliability and water quality |
| <ul style="list-style-type: none"> • Restore and protect channel islands from erosion and enhance habitat | <ul style="list-style-type: none"> • Provides habitat for aquatic and terrestrial plant and animal species • Improves water quality |
| <ul style="list-style-type: none"> • Restore about 1,500 to 2,500 acres of tidal wetlands in Suisun Bay | <ul style="list-style-type: none"> • Provides wet year spawning habitat for Delta smelt, rearing areas for salmon, and wildlife habitat (e.g. canvasback and redhead ducks) |
| <ul style="list-style-type: none"> • Restore riverine channel features in the San Joaquin River above the Delta to lower water temperature and to protect young fish from predation and straying | <ul style="list-style-type: none"> • Improves fish survival |

Considerations

- **Sacramento River Channels** – Feasible and cost-effective habitat restoration implemented between Sacramento and Collinsville.
- **Delta** – Candidate areas for shallow water habitat restoration include Prospect Island, Liberty Island, Little Holland Tract, Hastings Tract, Yolo Bypass, and the southeast Delta. Candidates for Delta levee habitat restoration include Twitchell Island along Threemile Slough and Sevenmile Slough, Georgiana Slough, and the North and South Forks of the Mokelumne River.
- **Floodway Corridors** – Habitat restoration must not impair capacity of floodways.
- **Suisun Bay** – Convert diked wetlands or create tidal wetlands with dredge spoils between Collinsville and Carquinez Strait.
- **San Joaquin River** – Confine wide, shallow channels and isolate in-channel gravel quarry areas. May not be self-sustaining.

Fish Protection and Transport

| Activities | Benefits |
|--|---|
| <ul style="list-style-type: none"> • Construct a San Joaquin River bypass at the head of Old River | <ul style="list-style-type: none"> • Encourages outmigrating fish to stay in San Joaquin River • Allows for managing flows down Old River |

| Activities | Benefits |
|---|---|
| <ul style="list-style-type: none"> • Install fish screens on moderate and high priority diversions in the Delta, rivers, and tributaries | <ul style="list-style-type: none"> • Reduces entrainment of fish |
| <ul style="list-style-type: none"> • Improve drainage in floodway corridors | <ul style="list-style-type: none"> • Reduces fish stranding |
| Considerations | |
| <ul style="list-style-type: none"> • Select diversions for screening according to criteria including size of intake, location, peril to fish, and screening feasibility. | |

Flood Protection and Levee Stabilization

| Activities | Benefits |
|--|---|
| <ul style="list-style-type: none"> • Provide a high level of protection and stabilization of Delta levees | <ul style="list-style-type: none"> • Manages vulnerability of Delta land use and infrastructure • Manages vulnerability of Delta water supply to salinity intrusion • Manages vulnerability of Delta ecosystem functions • Provides opportunities for habitat restoration |
| <ul style="list-style-type: none"> • Increase flood conveyance capacity of Delta channels through channel maintenance, improvements, and enlargements | <ul style="list-style-type: none"> • Manages vulnerability of levees to failure • Increases flood conveyance • Provides opportunities for habitat restoration |
| Considerations | |
| <ul style="list-style-type: none"> • Provide flood protection equivalent to Army Corps of Engineers PL 99 standard for these islands: <ul style="list-style-type: none"> All critical western islands such as Bethel Island. All islands with important regional infrastructure (e.g., Mokelumne Aqueduct) such as Woodward Island. All islands with valuable habitat such as Mandeville Island. • Upgrade all other Delta levees to meet at least the Hazard Mitigation Plan (HMP) standards. • Integrate protection and stabilization of levees with Delta habitat restoration activities. • Provide stable funding mechanism for ongoing levee and habitat monitoring, maintenance, and management. • Improvements and enlargements to channels include setback levees in channels with restricted flood capacity. | |

Operational and Management Features

Water Diversion Management

| Activities | Benefits |
|---|--|
| <ul style="list-style-type: none"> • Acquire about 100,000 AF of water from willing sellers in the San Joaquin basin | <ul style="list-style-type: none"> • Transports fish through San Joaquin River and Delta • Improves water quality • Improves management flexibility for diversions to reduce fish loss |
| <ul style="list-style-type: none"> • Improve CVP and SWP operations through predation control, coordinating operations, and improving fish salvaging and handling | <ul style="list-style-type: none"> • Reduces fish losses |
| <ul style="list-style-type: none"> • Improve real-time monitoring of locations of fish species of special concern and modify water diversions to avoid fish entrainment | <ul style="list-style-type: none"> • Provides an additional tool to help reduce entrainment of special-concern species • Improves flexibility to divert water during critical fish migration periods |
| <ul style="list-style-type: none"> • Evaluate, improve, and install behavioral barriers for anadromous fish | <ul style="list-style-type: none"> • Diverts anadromous fish from areas of potential entrainment and predation • Allows for continued water diversions at current locations |
| Considerations | |
| <ul style="list-style-type: none"> • Can use San Joaquin environmental water for pulse flows to aid fish transport or dilute poor quality flows. • Can use "Chain-of-Lakes" water to reduce direct in-Delta diversions during times of high environmental sensitivity. • Coordinate use of San Joaquin environmental water with the operation of new Delta storage to improve timing of diversions. • Evaluate continued use of an acoustic barrier at the mouth of Georgiana Slough. • Evaluate behavioral barriers for Delta Cross Channel and Threemile Slough. | |

Fisheries Management

| Activities | Benefits |
|---|---|
| <ul style="list-style-type: none"> • Mark salmon produced in hatcheries | <ul style="list-style-type: none"> • Facilitates selective catch of hatchery salmon by commercial and recreational fisheries |
| Considerations | |
| <ul style="list-style-type: none"> • Actions are intended to maintain recreational and commercial fisheries as well as enhance native salmon stocks. • Need to assess impact of incidental mortality on native (unmarked) fish. | |

Water Quality Management

| Activities | Benefits |
|---|---|
| <ul style="list-style-type: none"> Control agricultural, urban, and industrial discharges through retention and timed release | <ul style="list-style-type: none"> Improves Delta water quality |
| <ul style="list-style-type: none"> Increase enforcement of source control regulations for agricultural drainage and implement farming best management practices for water quality | <ul style="list-style-type: none"> Improves Delta water quality |
| <ul style="list-style-type: none"> Increase enforcement of source control regulations for urban and industrial runoff and implement best management practices for water quality | <ul style="list-style-type: none"> Improves Delta water quality |
| <ul style="list-style-type: none"> Integrate existing land retirement and fallowing programs for agricultural lands with drainage problems | <ul style="list-style-type: none"> Improves Delta water quality Provides potential land for habitat benefit |
| <ul style="list-style-type: none"> Integrate existing and support appropriate on-site mine drainage remediation measures to the maximum extent feasible | <ul style="list-style-type: none"> Improves Delta water quality |
| Considerations | |
| <ul style="list-style-type: none"> Implement discharge retention through cost-effective actions such as constructed wetlands, underground pipe storage, temporary storage ponds, or reuse. Time agricultural and industrial releases to coincide with higher instream flows. Identify priority pollutant sources such as Iron Mountain Mine and west-side San Joaquin agricultural lands. Provide regulatory and institutional incentives for implementation of remediation measures. | |

Institutional and Policy Features

Habitat Programs

| Activities | Benefits |
|---|---|
| <ul style="list-style-type: none"> Integrate recommended habitat restoration actions from other programs, including the Anadromous Fish Restoration Program | <ul style="list-style-type: none"> Provides additional habitat restoration |
| <ul style="list-style-type: none"> Establish programs to preserve agricultural land uses that provide valuable habitat functions | <ul style="list-style-type: none"> Protects existing habitats |
| <ul style="list-style-type: none"> Establish a CALFED team to coordinate and expedite habitat restoration permits | <ul style="list-style-type: none"> Accelerates acquisition of permits for environmental restoration projects and other CALFED projects |
| <ul style="list-style-type: none"> Establish a program to identify and use clean dredge materials from the Delta for habitat restoration and levee maintenance in the Delta | <ul style="list-style-type: none"> Provides materials for habitat and levee improvements |

| Activities | Benefits |
|---|---|
| <ul style="list-style-type: none"> Encourage farmers and levee maintenance districts to leave habitat areas undisturbed by working with resource agencies | <ul style="list-style-type: none"> Protects existing habitats Increases flexibility in maintenance programs |
| Considerations | |
| | |

Water Quality Standards

| Activities | Benefits |
|---|--|
| <ul style="list-style-type: none"> Reevaluate Delta export/inflow ratios during triennial reviews as habitat effectiveness is realized | <ul style="list-style-type: none"> Allows for higher level of water transfer as fishery populations improve |
| Considerations | |
| <ul style="list-style-type: none"> Monitor to verify effectiveness of habitat and entrainment reduction programs. Develop an adaptive management program to modify habitat restoration and export/inflow ratios in response to improved sustainability of important species. | |

Management of System Vulnerability

| Activities | Benefits |
|---|---|
| <ul style="list-style-type: none"> Establish and fund an emergency levee management plan to respond to levee failures | <ul style="list-style-type: none"> Provides resources to protect Delta functions through proactive and preventative measures |
| <ul style="list-style-type: none"> Establish landside buffer zones adjacent to levees on islands with deep peat soils | <ul style="list-style-type: none"> Provides increase in stability of Delta levees and reliability of Delta functions by reducing subsidence adjacent to levees Could be used to provide habitat benefit |
| Considerations | |
| <ul style="list-style-type: none"> Determine extent and cost effectiveness of levee management programs and buffer zones. Buffer strip approximately 150 to 200 yards wide dedicated to shallow wetlands. | |

Preliminary Assessment

Benefits

- Improves ecosystem quality through moderate habitat restoration and reduced diversion impacts
- Improves water supply predictability and reliability
- Improves water quality of diversions
- Funded levee management program significantly decreases vulnerability of Delta functions to catastrophic failure

Constraints and Concerns

- Organic carbon contributions within interconnected storage must be managed and reduced
- Social and environmental impacts from land use conversions
- Potential for degraded water quality in south Delta
- Some Delta islands remain vulnerable to flooding
- Best available screening technology and real-time monitoring may not be as effective as necessary to avoid entrainment effects at some diversion locations
- Larvae of some important fish species remain vulnerable to entrainment